Lesson 1

Neural Network Parameters: Weights and Biases

```
Neural Network Parameters
|
├── Weights
|   ├── Adjust connection strength
|   ├── Initialized randomly or strategically
|   └── Updated via gradient descent
|
├── Biases
|   ├── Shift activation function
|   ├── Initialized randomly
|   └── Adjusted to minimize error
|
└── Non-Linear Functions
    ├── Introduce non-linearity
    ├── Model complex relationships
    └── Examples: ReLU, Sigmoid, Tanh
```

Quick Reviewer

- **Weights**
  - **Adjust Strength**: Modify the influence of one neuron on another.
  - **Initialization**: Random or planned.
  - **Learning**: Optimized during training using gradient descent.
- **Biases**
  - **Shift Activation**: Allows for better fitting of the model by adjusting the function.
  - **Initialization**: Random.
  - **Learning**: Refined during training to improve accuracy.
- **Non-Linear Functions**
  - **Purpose**: Add complexity to the model.
  - **Impact**: Enable the network to learn and represent intricate patterns.
  - **Examples**: ReLU (Rectified Linear Unit), Sigmoid, Tanh.

Neural Network Training: Forward Propagation vs. Backward Propagation

```
Neural Network Training
│
├── Forward Propagation
│   ├── Compute output
│   ├── Process: Input -> Layers -> Weights -> Biases -> Activation Functions
│   └── Use: Making predictions
│
├── Backward Propagation
│   ├── Update parameters
│   ├── Process: Calculate gradients -> Propagate backwards -> Update weights/biases
│   └── Use: Training the network
│
├── Gradient Descent
│   ├── Optimize network
│   ├── Process: Calculate gradient -> Adjust parameters -> Minimize loss
│   └── Types: SGD, Mini-batch Gradient Descent
│
└── Loss Function
    ├── Measure performance
    ├── Quantifies error between predictions and actual values
    └── Guides optimization to reduce error
```

Quick Reviewer

- **Forward Propagation**
  - **What**: Computes network output.
  - **How**: Data → Layers → Weights/Biases → Activation Functions.
  - **When**: For making predictions.
- **Backward Propagation**
  - **What**: Updates weights and biases.
  - **How**: Calculate gradients → Backward propagation → Update parameters.
  - **When**: During training to minimize error.
- **Gradient Descent**
  - **What**: Optimization algorithm.
  - **How**: Compute gradient → Adjust parameters → Minimize loss.
  - **Goal**: Improve model accuracy.
- **Loss Function**
  - **What**: Measures prediction accuracy.
  - **How**: Quantifies difference between predicted and actual values.
  - **Role**: Guides training to reduce errors.